

a device for igniting and sustaining within the process chamber a plasma for said processing; and

a plasma confinement arrangement, comprising a magnetic array having a plurality of magnetic elements that are disposed within said process chamber, said plurality of magnetic elements being configured to produce a magnetic field, and wherein said plurality of magnetic elements are disposed around and extend along said plasma region, and wherein said magnetic elements are within said plasma region.

8. (Cancelled)

17. (Once Amended) A method for controlling a volume of a plasma while processing a substrate in a process chamber, said chamber defined at least in part by a wall, using a plasma enhanced process, comprising:

producing a magnetic field inside said process chamber with a magnetic array located inside said chamber;

creating said plasma inside said process chamber; and

partially confining said plasma within a volume defined at least in part by said magnetic field.

REMARKS

Claim 8 has been cancelled. Claims 2-7, 9-16, and 26-29 are pending. Claims 17 and 18 are withdrawn from consideration. Claims 2 and 17 have been amended. Claim 2 has been amended to recite that the magnets are within the plasma region. This is supported by page 6, lines 7 to 8, which says that the plasma fills the entire process chamber. Since the magnets are in the process chamber, they are in the region filled by the plasma.

The Examiner rejected claims 2-7, 12, and 26-28 under 35 U.S.C. 102, as being anticipated by Moslehi et al. (U.S. Patent 5,464,499).

Claim 2, as amended, recites that the magnetic elements are disposed within the plasma region. The Examiner states on page 3 of the final rejection, regarding claim 8 that

Moslehi does not disclose magnetic elements within the plasma region. For at least this reason, claim 2 is not anticipated by Moslehi.

Regarding claim 8, which had the same limitation as the amendment to claim 2 that the magnets are in the plasma region, the Examiner stated that Moslehi fails to expressly disclose the magnetic elements within the plasma region, but that Dandle discloses an apparatus with magnets in the plasma region and that it would have been obvious to modify the apparatus of Moslehi et al. so as to dispose the magnets within the plasma region because this would increase the magnetic coupling in the plasma which would improve the performance of the apparatus. The applicant was unable to find anything in either Moslehi or Dandle that discussed the advantage of increasing the magnetic coupling in the plasma. Nothing in Moslehi or Dandle suggests that it would be desirable to place the magnets of Moslehi in the plasma region. The applicant respectfully requests that the Examiner points out where in the reference this is suggested or supplies an additional reference to support this. For at least these reasons, claim 2 as amended is not made obvious by Moslehi in view of Dandle.

The Examiner rejected claims 9 and 13-14 under 35 U.S.C. 103 (a) as being unpatentable over Moslehi in further view of Ye et al. (U.S. Patent 6,178,920). The Examiner stated that Moslehi lacks anticipation of having the magnetic elements contained within sleeves, but that Ye discloses magnetic elements in a non-sputtering jacket to prevent plasma within the processing chamber from sputtering, so that it would be obvious to modify the apparatus disclosed by Moslehi so that the magnetic elements are individually contained within sleeves to reduce contamination of the substrate.

Claims 9 and 13-14 are ultimately dependent on claim 2. In addition, it would not be obvious to use the sleeves of Ye on the magnetic elements of Moslehi. The magnetic elements 72 are shielded from plasma by the chamber collar 38, which prevents plasma from reaching the magnetic elements 72. The applicant disagrees with the Examiner. As stated above, the Examiner stated regarding claim 8 in the office action that Moslehi fails to expressly disclose the magnetic elements within the plasma region. If the plasma is not able to reach the magnetic elements 72 of Moslehi, it would not be obvious to shield them from the plasma. The Examiner stated that Fig. 1 of Moslehi clearly shows that magnet 72 overhangs the portion of the chamber 38, which protects the magnet from plasma and thus the

magnets are exposed to intermittent plasma. Column 4, lines 66-67, of Moslehi states that FIG. 1 is a partial broken away diagrammatic view of the fabrication reactor plasma processing chamber 10. Column 5, lines 45-46, states that FIG. 2 shows a detailed diagrammatic cut-away side view of the preferred embodiment. It should be noted that the chamber collar 38 of FIG. 1 and FIG. 2 extends down to make a sealed chamber between the collar 38 and the outer wall 32. The magnets would be placed in this chamber between the collar 38 and outer wall 32 and plasma would not be able to reach the magnets. The collar 38 is not open on the bottom as the Examiner argues FIG. 1 shows, but instead the bottom part of the chamber has not been drawn in, since FIG. 1 is a broken away diagrammatic view and is a simplified schematic diagram (col. 3, line 29). No bottom is shown connected to the bottom of the outer chamber wall 32, yet the chamber wall 32 should be connected to something below to form the chamber. Instead, as shown in FIG. 2, both the collar 38 and the outer chamber wall 32 are connected to a support and seal the bottom of the chamber between the collar 38 and the chamber wall 32 at a significant distance below the showerhead assembly 54. Since this distance is so great, it is not shown in FIG. 1, but instead FIG. 1 is a partially broken away view, that does not show everything. Further evidence of this is from col. 5, lines 12-15, that states that the lid 12 contains support 36 that rests on the collar 38 at contact seal 40. The collar 38 must be supported by something. It is not supported by the lid or support 36, since the support 36 rests on the collar. Therefore the support for the collar 38 is not shown in FIG. 1, but is shown in FIG. 2. Also, if plasma freely flowed to the magnets 72, there would be no reason to have a seal 40. The region between the collar 38 and the outer wall 32 is a sealed chamber, and therefore seals 34 and 40 are used to maintain the seal. In addition, column 8, lines 54-56, states that the showerhead and collar hold residual deposits or contaminants that must be cleaned. Column 9, lines 1-16, discuss methods of cleaning the showerhead assembly 52, the collar 38, and the chuck 24. None of these processes discuss cleaning the magnets 72. If, as argued by the Examiner, the magnets 72 were exposed to plasma, the magnets would also have residual deposits or contaminants and would need cleaning. Since they are not cleaned, the magnets are shielded from the plasma, and therefore do not need sleeves. For at least these reasons, claims 9 and 13-14 are not made obvious by Moslehi in view of Ye.

Claims 3-7, 10-12, 15, 16, and 26-29 each depend either directly or indirectly from the independent claim, and are therefore respectfully submitted to be patentable over the art

of record for at least the reasons set forth above with respect to independent claim. Additionally, these dependent claims require additional elements that when taken in the context of the claimed invention, further patentably distinguish the art of record. For example, claim 29 recites that the plasma is able to fill the entire plasma process chamber in which the magnetic elements are disposed. For at least these reasons, claims 3-7, 10-12, 15, 16, and 26-29 are not anticipated or made obvious by the cited references.

Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at telephone number (831) 655-2300.

Respectfully submitted,
BEYER WEAVER & THOMAS, LLP

A handwritten signature in black ink, appearing to read "Michael Lee". The signature is fluid and cursive, with the first name "Michael" and the last name "Lee" clearly distinguishable.

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CLEAN VERSION OF PENDING CLAIMS

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2. (Twice Amended) A plasma processing apparatus for processing a substrate, comprising:

a process chamber, comprising:

a wall defining part of the process chamber;

a device for igniting and sustaining within the process chamber a plasma for said processing; and

C1 a plasma confinement arrangement, comprising a magnetic array having a plurality of magnetic elements that are disposed within said process chamber, said plurality of magnetic elements being configured to produce a magnetic field, and wherein said plurality of magnetic elements are disposed around and extend along said plasma region, and wherein said magnetic elements are within said plasma region.

3. The apparatus, as recited in claim 2, wherein said plurality of magnetic elements extend substantially from said first end of said process chamber to said chuck.

4. The apparatus, as recited in claim 3, wherein said magnetic field has an azimuthally symmetric radial gradient.

5. The apparatus, as recited in claim 4, wherein each magnetic element has a physical axis which extends along the plasma region.

6. The apparatus, as recited in claim 5, wherein each magnetic element has a magnetic axis which is substantially perpendicular to the physical axis.

7. The apparatus, as recited in claim 5, wherein said magnetic elements are permanent magnets.

8. (Cancelled)

9. The apparatus, as recited in claim 5, wherein said magnetic elements are individually contained within sleeves.

10. The apparatus, as recited in claim 5, wherein at least one of said magnetic elements is moved so that said magnetic field shifts over time.

11. The apparatus, as recited in claim 5, wherein said magnetic elements are rotated.

12. The apparatus, as recited in claim 2, wherein said magnetic elements are permanent magnets.

13. (Once Amended) The apparatus, as recited in claim 9, wherein said sleeves shield said magnetic elements from plasma.

14. The apparatus, as recited in claim 2, wherein said magnetic elements are individually contained within sleeves.

15. The apparatus, as recited in claim 2, wherein at least one of said magnetic elements is moved so that said magnetic field shifts over time.

16. The apparatus, as recited in claim 2 wherein said magnetic elements are rotated.

17. (Once Amended) A method for controlling a volume of a plasma while processing a substrate in a process chamber, said chamber defined at least in part by a wall, using a plasma enhanced process, comprising:

C2 producing a magnetic field inside said process chamber with a magnetic array located inside said chamber;

 creating said plasma inside said process chamber; and

 partially confining said plasma within a volume defined at least in part by said magnetic field.

18. The method, as recited in claim 17, further comprising the step of supporting the substrate on a chuck in the chamber, wherein the substrate is spaced apart from a first end of said process chamber, and wherein the plasma is substantially confined in a plasma region

between said first end of said process chamber and said substrate, and wherein said magnetic array, comprises a plurality of magnetic elements disposed around and extending along said plasma region between said first end of said process chamber and said substrate.

26. The apparatus, as recited in claim 2, wherein at least one magnetic element extends substantially from said first end of said process chamber to said chuck.

27. The apparatus, as recited in claim 26, wherein the plurality of magnetic elements are disposed around and outside the periphery of the substrate.

28. The apparatus, as recited in claim 26, wherein the magnet elements are placed to create a minimum magnetic field at the substrate.

29. (Once Amended) The apparatus, as recited in claim 2, wherein the plasma is able to fill the entire process chamber in which the magnetic elements are disposed.